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**REMARKS**

First of all, the Examiner is thanked for his time and insight during a telephone conference on April 3, 2007, during which the teachings of the cited references were discussed in relation to the independent claims.

The Office Action dated March 23, 2007 has been carefully considered. By this Amendment, Claims 13 and 15 have been amended, Claims 28-33 have been canceled, and Claims 35-57 have been added. Claims 13-15 and 18-27 and 34-57 are pending. Reconsideration of the application as amended is respectfully requested.

**Claim Rejections Under 35 U.S.C. § 103**

Claims 13, 20-22, 25, 27 and 34 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hooper (U.S. Patent No. 5,576,030) in view of Cochran (U.S. Patent No. 5,116,216) and Lang et al. (U.S. Patent No. 6,406,659).

Claim 14 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Hooper (U.S. Patent No. 5,576,030) in view of Cochran et al. (U.S. Patent No. 5,116,216) and in further view of Lang et al. (U.S. Patent No. 6,406,659).

Claim 15 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Hooper (U.S. Patent No. 5,576,030) in view of Cochran et al. (U.S. Patent No. 5,116,216) and in further view of Lang et al. (U.S. Patent No. 6,406,659) and White (U.S. Patent No. 5,427,725).

Claim 18 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Hooper (U.S. Patent No. 5,576,030) in view of Cochran et al. (U.S. Patent No. 5,116,216) and in further view of Palmer et al. (U.S. Patent No. 4,942,013).

Claim 19 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Hooper (U.S. Patent No. 5,576,030) in view of Cochran et al. (U.S. Patent No. 5,116,216) and in further view of Lang et al. (U.S. Patent No. 6,406,659) and White (U.S. Patent No. 5,427,725).

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Claims 23 and 24 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hooper (U.S. Patent No. 5,576,030) in view of Cochran et al. (U.S. Patent No. 5,116,216) and in further view of Imanara (U.S. Patent No. 5,364,584).

Claim 26 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Hooper (U.S. Patent No. 5,576,030) in view of Cochran et al. (U.S. Patent No. 5,116,216) and in further view of Stoeberl (U.S. Patent No. 4,120,632).

The 35 U.S.C. § 103(a) rejections are respectfully traversed.

#### **Overview of Patentability**

As will be shown below in the detailed analysis of the cited reference and the pending claims, it is respectfully submitted that the present application discloses a number of features that are neither shown by the cited references nor suggested by any combination of cited references, including but not limited to:

- forming a redundant double-bag arrangement in a resin-infusion method;
- forming a redundant double-bag arrangement by sealing both an inner and an outer bag to a mold;
- forming a redundant double-bag arrangement which provides a caul effect with respect to a preform when evacuated;
- forming a redundant double-bag arrangement with a pair of vacuum chambers such that if one of the vacuum chambers fails, the other vacuum chamber substantially maintains vacuum integrity;
- evacuating a pair of vacuum chambers such that an outer vacuum chamber collapses substantially against an inner vacuum chamber;
- evacuating redundant vacuum chambers such that an outer vacuum chamber has a pressure approximately equal to or greater than a pressure in an inner vacuum chamber; and

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- in any of the preceding arrangements, infusing resin into a preform while substantially maintaining evacuated pressure in the vacuum chambers.

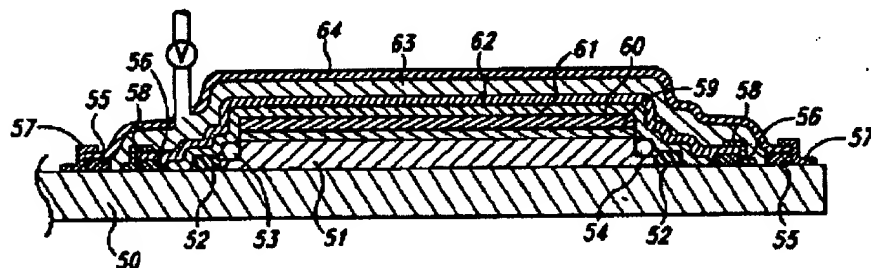
Accordingly, it is respectfully submitted that any method or apparatus for resin infusion that includes any one of these features is patentable. In the pending claims, each of the independent claims includes at least one of these features. As such, it is respectfully submitted that the pending claim set is patentable and in condition for allowance.

### Detailed Analysis

#### Claim 13

Claim 13 recites a method for double vacuum chamber resin infusion. Among other steps, claim 13 states (with reference numerals added):

- sealingly bagging the preform (51) to the mold (50) with an inner bag (62) forming a first vacuum chamber;
- sealingly bagging the inner bag (62) to the mold (50) with an outer bag (64) forming a second vacuum chamber;



**Fig. 2**

As can be seen in FIG. 2, the method of claim 13 includes the utilization of two bags (i.e., the inner and outer bags 62 and 64) each of which are sealingly bagged to a mold 50 to form two vacuum chambers.

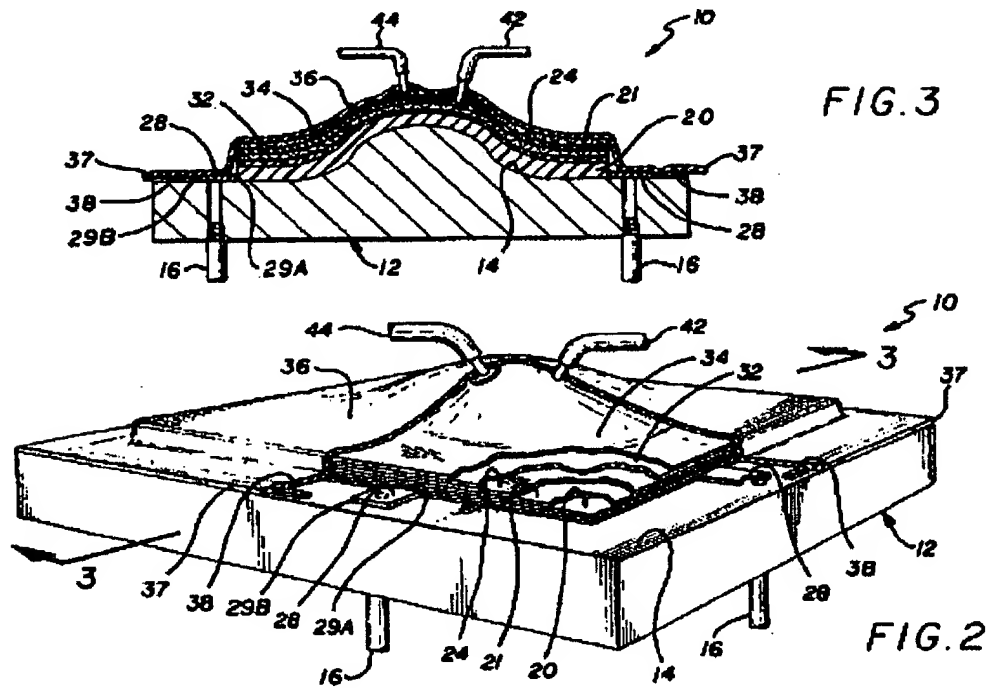
It is respectfully submitted that Hooper ('030) does not teach or suggest, among other things, the following features of claim 13:

1. sealingly bagging two bags to a mold; and
2. forming two vacuum chambers.

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The Office Action dated March 23, 2007 states on page 2-3:

... Hooper ('030) does not teach that the first bag is a vacuum bag and is sealed to the mold, or that the pressure in the second vacuum chamber is equal to or greater than the pressure in the first vacuum chamber. (emphasis added).



It is respectfully submitted that this characterization of the Hooper patent is erroneous.

As can be seen in FIGS. 2 and 3 from Hooper provided above, impervious flexible sheet (32) does not seal against mold (12) but rather appears to only extend to the edge of the layup (20). Accordingly, impervious flexible sheet (32) does not extend to the mold (12) and does not form a vacuum chamber. Indeed, Hooper confirms the same at col. 5, lines 4-12, by stating that impervious flexible sheet (32) has an area generally equal to the area of the lay-up 20.

Further, as impervious flexible sheet (32) does not seal layup (20) against mold (12), Hooper fails to teach or suggest a first vacuum chamber as recited in claim 13. One skilled in the art can understand that the impervious flexible sheet (32) of Hooper functions as a resin infusion

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barrier to prevent infused resin from migrating upwards away from layup (20) and into second sheet (34). Indeed, resin is infused through vacuum bag (36) and beneath impervious flexible sheet (32) via resin inlet port 42 and sealing tape (38) (see col. 5, lines 22-26).

Therefore, Hooper has only one vacuum chamber and not a first and a second as suggested by the Examiner. Expanding on the lack of teaching or suggestion of two vacuum chambers, Hooper states that “an impervious sheet 36, generally referred to as ‘vacuum bag’ is placed over the second sheet 34 and sealed by its marginal edges 37 to the mold surface 14 by means of a sealing tape 38 forming a sealed chamber 40” (see col. 5, lines 17-21). Accordingly, the sealed chamber 40 is the only sealed chamber that Hooper teaches and, as such, Hooper has only one vacuum chamber, not two as recited in claim 13.

The Office Action dated March 23, 2007 states on page 3:

**-However, Lang et al teach a first (185) and second (189) vacuum bags, each sealed to the mold (183). (emphasis added).**

As Lang teaches “first (185) and second (189) vacuum bags, each sealed to the mold (183)” and as Hooper “does not teach that the first bag is a vacuum bag and is sealed to the mold” and therefore has only one vacuum chamber, Lang is closer prior art than Hooper and Hooper is not relevant to the discussion of claim 13.

Claim 13 further recites, amongst other steps:

evacuating the second vacuum chamber with the pressure in the second vacuum chamber being equal to or greater than the pressure in the first vacuum chamber;

The Office Action dated March 23, 2007 further states about Lang on page 3:

... Lang et al further teach that the vacuum or pressures in the first and second bags are separately manipulated to provide resin flow channels or resin distribution (9:60-10:28) ... Thus, in view of the teaching to manipulate pressure in the two vacuum chambers (7:15-40, 8:38-46, and Claim 1), the particular pressures represent result effective variables that the ordinary artisan would modify, adjust, and optimize in order to provide resin channels or distribution. (emphasis added).

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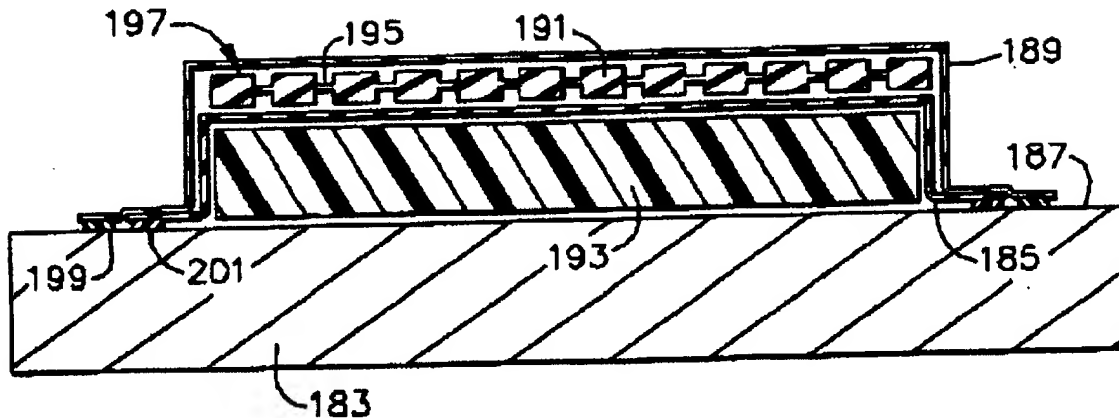


FIG. 8

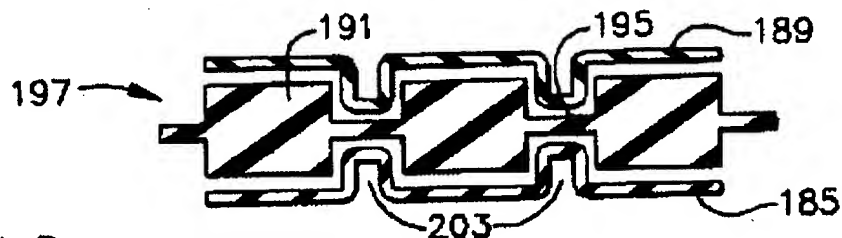


FIG. 10

Lang teaches away from Claim 13 as Lang et al. applies a differential pressure with the greater pressure on the preform side of the inner bag and a lesser pressure on the spacer system, outer bag side, Col. 7, lines 22-27 as follows:

A resin pressure on the preform side of the flexible mold greater than the pressure in the channels below the surface of the flexible mold causes the flexible mold material between the channels and the preform to deform into the interior channels and thereby create resin distribution channels on the surface of the preform.

Pressures in Lang's inner and the outer bags can be manipulated "... in the two vacuum chambers ..." as suggested by the Examiner. "... the particular pressures represent result effective variables that the ordinary artisan would modify, adjust, and optimize in order to provide resin channels or distribution." Pressure pressures within the bags can be manipulation, provided that the pressure in the inner bag remains greater than the pressure in the outer bag.

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Every embodiment of Lang relies upon the temporary creation of resin distribution channels to distribute the resin above the preform prior to resin flowing into the preform as stated in Col. 3, lines 46- 54 as follows:

Though there are many features and embodiments of the present invention, the essence of the invention is a method and the related apparatus for molding a composite by infusing resin into a permeable preform, comprising the creation of temporary resin channels on the surface of the preform, flowing resin along the channels and from the channels into the preform, stopping the flow of resin, removing the temporary channels if desired, curing the resin in the preform and forming a composite.

If the differential pressure of Claim 13 is applied to Lang, namely that a lesser pressure is applied to the preform side of the inner bag and a greater pressure on the spacer system between the inner and outer bag or if both pressures are equal, then resin distribution channels 203 of Fig 10 above cannot be formed. If the pressure distribution of Claim 13 is applied to Lang the inner bag would not collapse against the individual spacer 191 as shown in Figure 10 and therefore no resin distribution channels 203 would be formed. There would be no means to channel the resin above the preform as taught by Lang and at best a poor quality infusion would occur.

The Office Action dated March 23, 2007 states about Cochran on page 3:

.... Cochran et al ('216) teach a resin **impregnation** process including, providing a fibrous prepreg (61), placing said **prepreg (61)** onto a mold (71), sealing a first vacuum bag (89) against said mold (12) to form a first vacuum chamber, **sealing a vacuum cover (93) to form a second vacuum chamber**, drawing a vacuum onto said first chamber and onto said second vacuum chamber such that the **pressure within said second chamber is higher than the pressure within said first vacuum chamber** and **impregnating fibrous pre-preg by applying heat** (see col. 5, line 60 through col. 6, line 11 and figure 3). (emphasis added).

It is respectfully submitted that this characterization of the Cochran patent is erroneous.

Vacuum cover (93) is sealed to vacuum bag (89) to form a second vacuum chamber.

Vacuum cover (93) is not sealed to mold (71).

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By definition, a prepreg has already been impregnated with resin. Indeed, the preform of Cochran is impregnated with resin prior to being placed between flexible bag 89 and steel base plate 71. Cochran does not disclose or teach a means for resin infusion of the preform, let alone resin infusion of a preform after it is placed in a mold. Claim 13 infuses resin into a dry preform after it is placed into the mold. This distinction between impregnating a dry preform while in a mold and placing an impregnated preform into a mold goes to the most fundamental distinction between composites.

The application of heat in Cochran does not "impregnate said fibrous pre-preg" as asserted by the Examiner. Again, the prepreg is pre-impregnated. The application of a vacuum along with the application of high heat removes voids between the plies, trapped gases and other volatiles from the prepreg and melts the pre-impregnated plies together (see col. 4, line 46-47 and col. 5, line 60 through col. 6, line 14 and figure 3). Removing trapped gases and other volatiles from the prepreg and raising the temperature to above the melting temperature of the resin further distinguishes Cochran from Claim 13. Indeed, Lang teaches that "the resins may be catalyzed for high temperature cure or room temperature cure and for various cures times as is compatible with the needs of the molding process. The resin should be properly catalyzed and degassed prior to injection into the preform cavity. The wide variety of useful resins and the methods of preparing the resin are all widely known in the art." (Col 3, lines 3-6). The resin infused in Claim 13 is in a liquid state prior to being "catalyzed" during the application of heat and pressure. Lang also teaches that resins are "degassed prior to injection into the preform cavity", so removing trapped gases and other volatiles occurs prior to resin injection and not from a prepreg within in a mold. As the resin of Claim 13 is in liquid form prior to and during injection, no melting of the "pre-impregnated plies together" needs to occur to make the resin flow. Therefore, Cochran teaches placing a preform in a mold with a higher second chamber pressure than the pressure within the first vacuum chamber under high heat to melt prepreg plies together and remove trapped gases and other volatiles. The teachings of Cochran are not applicable to the method of Claim 13.



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Cochran is not analogous art to Claim 13 and one of ordinary skill in the art would not combine Cochran with Lang.

Again, Lang will not function if the pressures in Lang are modified as suggested by Cochran "... such that the pressure within said second chamber is higher than the pressure within said first vacuum chamber ...". The temporary resin distribution channels, such as resin distribution channels 203, will not be formed and there will be no means for distributing the resin prior to infusion into the preform.

Accordingly, it is respectfully submitted that a prima facie case of obviousness has not been established by the Patent Office because the cited references do not provide any suggestion on how to combine or modify the references, with the combination or modification being sufficient to render Claim 13 obvious to one of ordinary skill in the art. Therefore, it is respectfully submitted that Claim 13 is patentable over the Hooper, Lang and Cochran patents and is in a condition for allowance.

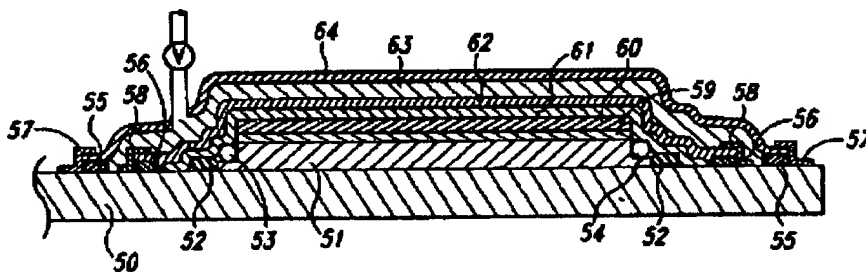
Claim 14, 15, and 18-27 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hooper (U.S. Patent No. 5,576,030) in view of various combinations of Cochran et al. (U.S. Patent No. 5,116,216), Lang et al. (U.S. Patent No. 6,406,659), White (U.S. Patent No. 5,427,725), Palmer et al. (U.S. Patent No. 4,942,013), Imanara (U.S. Patent No. 5,364,584), and Stoeberl (U.S. Patent No. 4,120,632). Each of these claims depends from Claim 13. For reasons analogous to those presented above in relation to Claim 13, it is respectfully submitted that each of the cited references, either alone or in combination, fails to teach or suggest the respective methods of Claims 14, 15, and 18-27.

#### **Claim 34**

Claim 34 recites a method for double vacuum chamber resin infusion. Among other steps, Claim 34 states (with reference numerals added):

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bagging the preform (51) to the mold (50) with an inner bag (62) forming a first vacuum chamber;  
bagging the inner bag (62) to the mold (50) with an outer bag (64) forming a second vacuum chamber;  
evacuating the first vacuum chamber;  
evacuating the second vacuum chamber such that the second vacuum chamber collapses substantially against the first vacuum chamber;



*Fig. 2*

The Hooper patent is discussed above. In contrast to Claim 34, Hooper does not teach or suggest bagging with inner and outer bags to form first and second vacuum chambers. Accordingly, it is not possible for Hooper to evacuate the first and second vacuum chambers as recited in Claim 34.

The Office Action dated March 23, 2007 further states about Lang on page 3:

... Lang et al further teach that the vacuum or pressures in the first and second bags are separately manipulated to provide resin flow channels or resin distribution (9:60-10:28), and doing so **substantially collapses the second vacuum chamber against the first vacuum chamber** (Fig 10). (emphasis added).

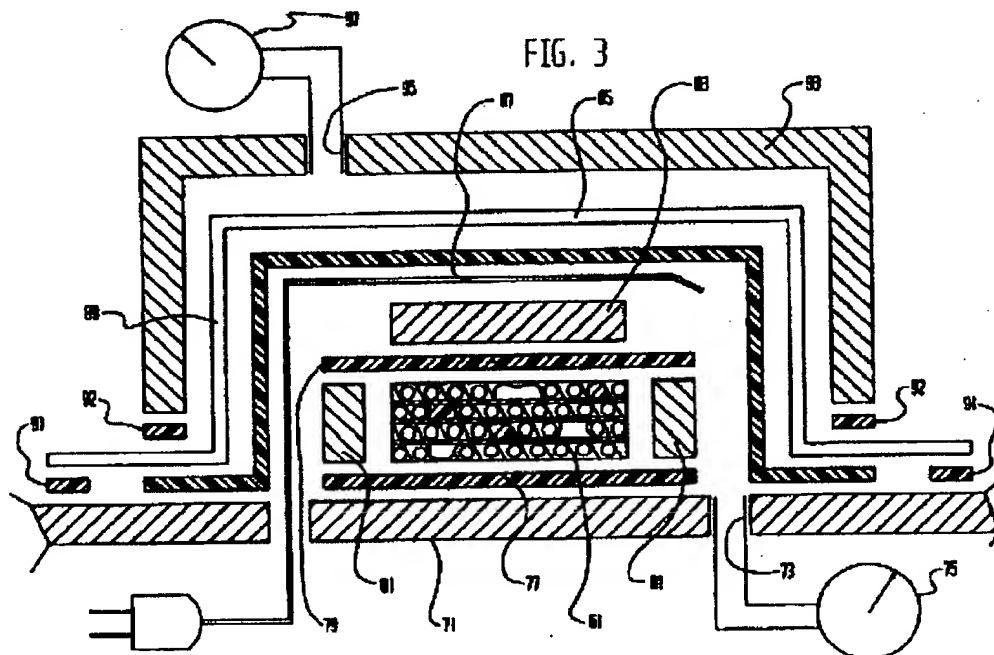
It is respectfully submitted that this characterization of the Lang patent is erroneous.

Lang et al "... positions a spacer system (191) onto said inner bag, placing an outer vacuum bag (189) onto said spacer system (191) to form a second vacuum chamber..." as stated by the Examiner in the office action dated July 11, 2006 and shown in Figures 9-12 of Lang et al.

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(Figure 10 above). Spacer system (191) prevents the second vacuum chamber from collapsing substantially against the first vacuum chamber. Lang et al. fails to anticipate Claim 34.

Cochran et al. also fail to teach or suggest "evacuating the second vacuum chamber such that the second vacuum chamber collapses substantially against the first vacuum chamber". Cochran has a first vacuum bag (89) sealed against the mold (12) to form a first vacuum chamber, but has a rigid vacuum cover (93) sealed against first vacuum bag (89) to form a second vacuum chamber. Vacuum cover (93) is not sealed against mold (12), but instead is sealed against first vacuum bag (89). Also, the vacuum cover (93) is rigid and cannot collapse against the first vacuum bag (89), so evacuating the second vacuum chamber such that the second vacuum chamber collapses substantially against the first vacuum chamber is impossible.



Accordingly, it is respectfully submitted that a prima facie case of obviousness has not been established by the Patent Office because the cited references do not provide any suggestion

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on how to combine or modify the references, with the combination or modification being sufficient to render the method of Claim 34 obvious to one of ordinary skill in the art. Therefore, it is respectfully submitted that Claim 34 is patentable over the Hooper and Cochran patents and is in a condition for allowance.

### NEW CLAIMS

New Claims 35-45 depend from Claim 34. For reasons analogous to those presented above in relation to Claim 34, it is respectfully submitted that each of the cited references, either alone or in combination, fails to teach or suggest the respective methods of Claims 35-45.

Support for new Claims 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56 and 57 can be found in the specification and in the following exemplary passage, but support relied upon is not limited to this section:

[0012] ... The "double bag" also provides increased **vacuum integrity** because it provides a **redundant, second bag** to counter any leaks in the first bag. (emphasis added).

Support for new Claims 47, 52 and 54 can be found in the specification and in the following exemplary passage, but support relied upon is not limited to this section:

[0011] ... The double bag provides a **caul effect**. ... the bag is never able to relax behind the wave front .... (emphasis added).

[0012] ... The "double bag" becomes a means to reduce flow over the filled flow media **because the vacuum bag effectively is thicker**. ... (emphasis added).

### CONCLUSION

In view of the foregoing, and the remarks presented above, it is respectfully submitted that the present application is in condition for allowance. As such, the issuance of a Notice of

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Allowance is therefore respectfully requested. In order to expedite the examination of the present application, the Examiner is encouraged to contact the undersigned attorney in order to resolve any remaining issues.

It is not believed that extensions of time or fees for net addition of claims are required, beyond those that may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 CFR § 1.136(a), and any fee required therefore (including fees for net addition of claims) is hereby authorized to be charged to Deposit Account No. 18-1730.

Respectfully submitted,



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